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ABSTRACT

Based on experiences gained through involvement with three curriculum development projects, one relating to an elementary science curriculum and the other two relating to junior high school mathematics, the following recommendations are presented: (1) financial support from an outside agency, public or private, makes boldness more probable in curriculum development; (2) curriculum development is an important kind of educational research highly appropriate for the National Institute of Education (NIE) to support; (3) curriculum development of the future should have several types of sources of support and of sponsoring agencies; (4) first priority should be given to teams of scholars and teachers and to interdisciplinary projects; and (5) NIE should support research, development, and implementation in a 50-30-20 ratio, respectively. (Author/DS)

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SOME THOUGHTS ABOUT CURRICULUM DEVELOPMENT

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A paper prepared for the
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SOME THOUGHTS ABOUT CURRICULUM DEVELOPMENT

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Abstract

The articulation of what has been learned and the conclusions and recommendations of this paper are based on experiences in an administrative role with three curriculum development projects. One of these projects was supported by a private foundation; two, by NSF. Two were sponsored by universities; the third, by a professional society. One involved a small staff and regional tryout; the others, many writers and nationwide tryout. One utilized carefully stated objectives; the others did not. They differed in methods of dissemination and implementation. All three depended upon teamwork of teachers and scientists.

From these experiences I learned that curriculum development is an exciting venture of great value to all participants and to those institutions and people with whom they work and is one of the most effective ways of influencing education. The importance of the teacher in the learning situation, even with the best of materials, became more evident, as did the desirability of new research on how to tryout new materials and to evaluate them and how best to introduce them to the public.

It is concluded here that financial support from an outside agency, public or private, makes boldness more probable in curriculum development, that curriculum development is an important

kind of educational research highly appropriate for NIE to support, and it is recommended that curriculum development of the future should have several types of sources of support and of sponsoring agencies. It is further recommended that first priority be given to teams of scholars and teachers and to interdisciplinary projects. Multiple efforts should be supported at each level. Support should also be provided for feasibility and planning conferences. A 50-30-20 ratio of NIE support for research, development, and implementation is proposed.

Background

While on a part-time appointment at the University of Maryland, I served as director of the University of Maryland Mathematics Project (UMMaP). The goal of UMMaP was the development of modern courses in mathematics for junior high schools. When the School Mathematics Study Group (SMSG) was organized, an invitation came and was accepted to become chairman of the SMSG Committee on junior high school mathematics because of the Maryland experiences. Later, as director of education of the American Association for the Advancement of Science (AAAS), I became director of a program under which an elementary school science curriculum was developed. Naturally each of these experiences influenced those to follow, and each in its own way has contributed much to present memories, satisfactions, concerns, and interests, and directly to the learnings and conclusions of this paper.

One of these projects was supported by a private foundation; two, by the federal government. Two were sponsored by universities; one, by a scientific society. One involved a small staff and regional tryout; the others, a large staff of writers and nationwide tryout. One utilized carefully stated objectives and a built-in evaluation; the others did not. They differed in methods of

dissemination and implementation. These variations all relate to issues important in formulating plans for future curriculum development. Perhaps of the greatest consequence, all three depended upon the leadership and teamwork of teachers and scholars.

During the past two decades of curriculum development, the right words never seemed to be identified to name the two important personnel components of curriculum development teams: teachers and scholars. The hundreds of very effective teachers in the schools who contributed so much to the curriculum development projects were surely also scholars and researchers. The university scholars upon whom the projects depended so heavily, if effective in the team, must surely also have been master teachers. Hence the ambiguity and inadequacy of terms. Because the projects reviewed in this paper were in science, the terms teachers and scientists are used, but with apologies to both groups. The teachers were scientists in teaching and learning, and the scientists were master teachers. Almost certainly that is why they worked so well together.

The University of Maryland Mathematics Projects (UMMaP)

By the middle 1950's high school mathematics curriculum development under the direction of the late Max Beberman was under way at the University of Illinois with the support of the Carnegie

Corporation of New York and already arousing national interest. When asked by a staff member of Carnegie to suggest a university where there might be interest in developing experimental materials for junior high school mathematics, my immediate response was the University of Maryland, where I had only recently accepted appointment (part-time) beginning in September 1957. With full cooperation of the Department of Mathematics and the College of Education a proposal was prepared, submitted to Carnegie, and funded. From the beginning the principal authors of the junior high school courses were a young Ph.D. mathematician brought to Maryland from the University of Nebraska, and a mathematics supervisor who came to the University from Arlington County, Virginia. Both were employed full-time by the University for the project. This arrangement illustrates what I have often claimed as my principal contribution to curriculum development -- to obtain the support and then to choose the right people to do the work.

Junior high school mathematics teachers in the immediate area were invited to enroll in a seminar on topics in modern mathematics offered for graduate credit. From 12 to 20 teachers participated each year. Seminar participants were also expected simultaneously to try out the new materials in their classes. Time at each seminar was given to discussion of teaching experiences. Courses for grades 7 and 8 were developed, published by the project, and copies sold, essentially at cost, to interested teachers upon

request. After a number of years, when UMMaP had turned its attention to other matters and one of the two principal authors of the curriculum materials had left the University for a position at Purdue, this man and two junior high teachers, one from Maryland and one from Virginia, who had been participants in the seminar became the authors of commercially sponsored textbooks which became widely used.

UMMaP has operated continuously from its beginning in 1957. My association with UMMaP was during the first 10 years only. Presently the faculty and graduate students are publishing a text in mathematics for elementary school teachers, an area in which UMMaP has provided important national leadership in the past decade. A project started for school curriculum development continues after two decades to make other significant contributions to education.

School Mathematics Study Group (SMSG)

(Junior High School Level)

At the time of the organization of the School Mathematics Study Group in 1959, I became chairman of the Committee on Junior High School Mathematics, and for the next few years gave time to this project in summers, rather than to UMMaP. Because SMSG was organized with the encouragement of the American Mathematical Society and the Mathematical Association of America, it seemed to

me then that to join forces was exactly the right thing to do. That opinion still holds without regret and with only the reservation that it will always be important that there be several "new" programs in each discipline at each level from which schools can choose. I served as junior high school chairman, which included the responsibility for grades 7 and 8 tryout through the development of the first edition.

From the beginning SMSG possessed assets which almost guaranteed its success, such as adequate support of the National Science Foundation, encouragement of the leading mathematical societies, a wise director who enjoyed the full confidence of the mathematical community, sponsorship by two prestigious universities -- Yale and Stanford, and acceptance of a broad responsibility for modernization of the mathematics curriculum, kindergarten through grade 12, including teacher education. Furthermore, SMSG succeeded in bringing teachers into full partnership with mathematicians from the beginning.

After initial planning sessions the committee for grades 7 and 8 worked at the University of Michigan in the summer of 1960 while the other SMSG teams were at Stanford. Some 40 teachers and mathematicians were involved, and during these eight weeks a remarkable degree of teamwork developed. The next summer all the teams were at Stanford making possible more cooperative planning

among the several levels, yet allowing a considerable freedom for each team. SMSG courses were published by the Yale University Press. At one point after the experimental editions were rather widely used, SMSG appointed committees to examine commercially sponsored texts to determine which more clearly incorporated SMSG ideas. While the committees concluded that none carried out the SMSG ideas in full, almost any observer would conclude that SMSG influence continues to be widespread internationally as well as nationally.

Commission on Science Education

Starting in the fall of 1960 the AAAS, with NSF support, sponsored three regional conferences (St. Louis, San Francisco, and Washington, D.C.) to determine the interest of school personnel and scientists in the development of curriculum materials in science at the elementary school level and to explore the feasibility of NSF support of this work. As is often true of feasibility studies the conferences concluded that this work was feasible and urgent. Nevertheless, even though the conclusions might have been predicted, the conferences served a number of very useful purposes. For example, leaders in elementary school education came together with scientists to discuss a problem of mutual interest and found that they could communicate. In the subsequent developmental work, it was clear that the scientists and the school people saw a need

and were more than willing to work in a new relationship in a major effort to improve a part of the school curriculum. The conferences and a fourth summary session in 1961 strongly recommended that several projects be supported so that the schools would have a number of programs from which to choose.

The next year the AAAS Board of Directors appointed a Commission on Science Education (originally called the Commission on Elementary and Junior High School Science). Members were elementary school teachers and administrators and scientists, including two psychologists. Conferences held in the summer of 1962, at Cornell University and the University of Wisconsin, started the preparation of outlines for an elementary school science curriculum and planning for other tasks that the Commission might undertake. Simultaneously, work was being undertaken by several other groups, also with NSF support in the development of new science programs for elementary schools as recommended by the feasibility conferences. NSF supported this preliminary planning and the development of the first edition of Science-A Process Approach.

With financial support and confidence that it enjoyed support of school people and scientists, the Commission was able to be bold in its overall design. Science-A Process Approach consisted of texts for teachers and kits of "hands-on" material for children. The development of competence in the processes of science was accepted as the primary goal of the program. The materials for kindergarten

through grade 6 were developed through some 20 exercises for each grade level, each with clearly stated objectives, a rationale, a series of instructional procedures, and test items to determine if the children attained the objectives. Those responsible for the program take much satisfaction from the attempt to build in an evaluation of the program from the beginning.

The program was developed by teams of scientists and teachers, usually numbering about 40 in five summers, 1963-67, with supervised tryout in schools between summers. In each summer after the first, revision based on tryout results was carried out along with preparation of new materials. The personnel of writing teams varied from summer to summer and each year one or more new schools were added to the tryout, and some were discontinued or dropped out by their own choice. A contract for publication by the Xerox Corporation was agreed upon in January 1967, with NSF approval. Teacher education materials were prepared and also tried out, but the Commission mainly depended upon the initiative of colleges and universities to offer summer institutes for school personnel interested in the program rather than seeking support for Commission sponsorship.

During the development of Science-A Process Approach the Commission on Science Education also accepted a responsibility to disseminate information on science education precollege and undergraduate levels and to provide some leadership in other projects.

The dissemination efforts are best represented by the periodical Science Education News, which continues as an AAAS publication, and the Reports of the International Clearinghouse on Curriculum Developments in Science and Mathematics. The latter was made possible by the cooperation and leadership of the Science Teaching Center of the University of Maryland. In the early 1970's the Commission, with the cooperation of the National Association of State Directors of Teacher Education and Certification, published guidelines for the education of science teachers. A major part of support for these other activities was also provided by NSF.

What I Have Learned

This brief review of personal, professional experiences and pleasures with three curriculum development projects does not permit the desired logical analysis upon which to base conclusions and recommendations. Those events in my life and in the curriculum projects that seem to relate most closely to issues associated with future government support of curriculum development are reported. No attempt was made to review thoroughly the many papers and documents of the past two decades relating to these issues. The memories and impressions that remain after three years in an exciting new university experience, rather far removed from science education as such, may have led to more objective conclusions. This is my hope.

These things I believe I learned. Curriculum development can be an exciting venture and one of the most effective ways to influence what is going on in education. The bringing together of scholars and teachers is an exceedingly valuable experience for everyone concerned and my faith in the value of this approach to curriculum development has been greatly increased and supported by my experiences.

In curriculum development and the observation of the use of new materials, one becomes more convinced of the importance of the teacher in the learning and teaching situation. Those who prepare curriculums are tempted to think that from just the right teaching materials (those they have developed), anyone can learn and, furthermore, that if the right teaching materials with the appropriate aids are made available to teachers, anyone can teach. Experience with curriculum development tends to make one less certain of these points, even while recognizing the very great value of the new products.

The tryout centers in the development of Science-A Process Approach, and probably in SMSG and other projects, were chosen to provide a wide distribution. Possibly also in the planners' minds was the desire to have a kind of national coverage as an aid to introduction of the program to the public. Certainly the geographic distribution and the spread of economic and cultural backgrounds of schools selected for the tryout are desirable. However, if

scientific sampling were to be utilized in the future in making these choices, a lower operation cost might result. It seems likely that most projects utilized more tryout centers than needed and feedback reports did not always get to the real problems.

It seems highly desirable in development projects that objectives be clearly identified and that there be a planned evaluation of the attainment of these objectives as the development proceeds. Built-in objectives and evaluations can be an exceedingly important part of the developmental process. Furthermore, those agencies supporting development should also support evaluation by an outside agency as well. Ready comparison is possible if all the programs have similar objectives, but this is rarely the case. Other means of comparison must be developed.

In the three projects reviewed in this paper different methods were used to make the materials available to the public. Each of these methods has advantages. The editorial staff of Ginn and Company, a part of the Xerox Corporation, gave helpful suggestions in preparing Science-A Process Approach for publication and Ginn sales effort has surely brought about a much wider use of the program than would otherwise have been possible. Yet as time passes I tend to think that the primary values to be derived from curriculum development, on the scale of the three projects on which this paper is based, are derived from the education of project participants,

and the demonstration of a development process and the production of a model which are sound enough to affect significantly what others do. Thus I become a little less concerned about methods of dissemination and implementation. Perhaps this is because of personal involvement in producing the model, while depending primarily on others for dissemination and implementation.

Conclusions

Those things that were learned and conclusions are not clearly distinct. Furthermore, some implied recommendations crept into the preceeding assessments. In further attempts at refinements, those things learned about which I feel most convinced now are formulated as conclusions.

1. Financial support from outside the agency sponsoring a curriculum development project encourages bold new approaches. Removal of the profit-making motive makes boldness more possible. Support of private foundations is important and perhaps even more important is support from the federal government, including the National Science Foundation, the National Endowments for the Arts and Humanities, and the National Institute of Education.

2. Curriculum development resulting in a product carefully tried out and evaluated is an important part of educational research and hence especially appropriate for the National Institute of Education.

3. Innovative curriculum development planned to have widespread national influence can appropriately be sponsored by a university, by a professional society, by an education laboratory, and also by private agencies. It is important that several types of sponsorship be utilized.

4. The experiences of the past two decades have proved the efficacy of curriculum development by teams of scholars and teachers. First priority should be given to support of such teams. In addition to the quality of the product of these teams, there are many secondary benefits to be derived, such as the value for school and university personnel to be more closely associated for their mutual benefit, and for the benefit of education in the broad sense.

5. As funding agencies consider proposals for support of course content development projects, they should recognize that these projects provide a strong motivation for teachers to study, to learn, to expand their horizons, to re-examine their teaching methods, and to enjoy doing so. In more than 40 years of association with teacher education, I have observed no other motivating factor half so effective.

6. It is recommended that support be provided for research in special aspects of curriculum development including methods of conducting the tryout, methods of evaluation both by the sponsoring agency and an outside agency, development of guiding principles for

comparison of two projects which differ in statement of objectives, and methods of disseminating the product to the educational community and public. This research might be a built-in part of a curriculum development project itself or a separate research study. Such investigations seem especially appropriate for support by the National Institute of Education.

7. Interdisciplinary projects should be encouraged and supported and given priority, as should projects spanning several years of school experience.

8. When government support is provided, several independent projects concerned with the same school subjects and level should be supported, as in the case of elementary school science.

9. The regional feasibility conferences sponsored by AAAS in 1960-61 and the subsequent planning conferences the next year proved to be useful models and should be encouraged and supported, whether or not they lead to major development projects.

10. NIE should divide its funds and efforts among research, development of new products, and implementation of research findings and research-based products approximately in the ratios 50-30-20 respectively, with research including the search for better curriculum development methods for tryout, evaluation, and implementation.

11. The concern of this paper for curriculum development in

major projects attracting nationwide attention and operating with support by government or private agencies should not be interpreted to imply lack of recognition of the great value also in curriculum development by state and local education agencies. Support for state and local curriculum development efforts should also be seriously considered by public and private funding agencies.